Recommended

FUTURE ROLE OF THE FEDERAL GOVERNMENT

with respect to

RESEARCH IN SYNTHETIC RUBBER

SPECIAL COMMISSION FOR RUBBER RESEARCH
NATIONAL SCIENCE FOUNDATION

December 1955

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LETTER OF SUBMISSION

December 5, 1955

The Honorable Alan T. Waterman
Director, National Science Foundation
Washington 25, D. C.

Dear Dr. Waterman:

The Special Commission for Rubber Research has the honor to submit herewith its report and recommendations arising out of its inquiry into the role of the Federal Government in future research in synthetic rubber.

The Commission has considered the question whether there is need for continuation of the present program of Government-sponsored research projects in synthetic rubber and whether the Government should continue to maintain its rubber laboratories at Akron, Ohio.

The Commission has surveyed the research programs of the Defense establishment and of the National Bureau of Standards which relate to synthetic rubber only so far as seemed necessary to establish the relation between specially oriented research sponsored by these agencies and the broader research programs of the National Science Foundation.

The Commission has not attempted to weigh the effect on the national security, and specifically on the natural rubber stockpiling program carried out by the Office of Defense Mobilization, of recent rubber research discoveries by industrial companies which appear to lay the scientific foundation for a new American industry of producing a synthetic substitute for natural rubber. The Commission has however recommended that the question of the need, if any, for Governmental action to foster such an industry be given consideration at the highest levels of Government.

The members of the Commission have felt a deep sense of responsibility in being called upon to render service in the area of public policy covered by this inquiry. They hope that the

findings and recommendations herein submitted will give useful guidance to the National Science Foundation, to other interested agencies of the Executive Branch of the Government, and to the Congress, in fixing the future course of the Government in the fields which have been examined by the Commission.

Respectfully submitted,

Chairman

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Member

Member

Member

Member

Member

Member

Member

Member

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PREFACE

In early 1953, the Administrator of the Reconstruction Finance Corporation submitted a program for the disposal to private industry of the synthetic rubber plants owned by the Government. This report was incorporated in proposals for legislative action transmitted by the President to the Congress in April, 1953 which in turn resulted in the enactment of the Rubber Producing Facilities Disposal Act of 1953 (P.L. 205, 83rd Cong. 1st Sess.), signed by President Eisenhower on August 7, 1953. The Act provided among other things for: (a) the establishment of a Rubber Producing Facilities Disposal Commission charged with negotiating contracts of sale of synthetic rubber plants, such contracts to become effective unless disapproved by either House of Congress; (b) exclusion of the Government Laboratories at Akron from the provisions of the Act; and (c) the submission of a report from the President to the Congress at the expiration of one year after the transfer of the plants, such report to cover the Nation's rubber requirements and resources, "and the need, if any, for further research by the Government relative to the production or use of synthetic rubber and its component materials."

The Disposal Commission presented its report to the Congress on January 24, 1955, setting forth the program for sale and other transfer of Government-owned rubber producing facilities. In the absence of Congressional disapproval, the transfer contracts negotiated by the Commission became effective in late April, 1955 and the plants and other facilities passed into private hands. The Disposal Commission recommended that the Research and Development Program previously carried on by the Office of Synthetic Rubber of the Federal Facilities Corporation (successor agency to the RFC) be discontinued in part, with the remaining parts--research contracts at universities and other organizations, and the Government Laboratories at Akron--transferred to the National Science Foundation. The Commission recommended that the Foundation provide supervision and management to the program during a trial period running at least through the Fiscal Year 1956, and further that the Foundation through a Special Commission established for such purpose, evaluate the program and develop recommendations as to the need, if any, for continued financial support of such research by the Federal Government. Pursuant to the recommendations of the Disposal Commission and in accordance with Section 9 of the National Science Foundation Act of 1950 (P.L. 507-81st Cong., 2nd Sess.) a Special Commission for Rubber Research was authorized by the National Science Board at a meeting on May 18, 1955. Aso in accordance with the recommendations of the Disposal Commission, and with the approval of the Bureau of the Budget, the National Science Foundation assumed responsibility for the rubber research program as of July 1, 1955.

Section 9, P.L. 507 provides as follows: "(a) Each special commission shall consist of eleven members appointed by the Board, six of whom shall be eminent scientists and five of whom shall be persons other than scientists. Each special commission shall choose its own chairman and vice-chairman. (b) It shall be the duty of each such special commission to make a comprehensive survey of research, both public and private, being carried on in its field, and to formulate and recommend to the Foundation at the earliest practicable date an over-all research program in its field."

The Special Commission for Rubber Research (hereafter referred to in this Report as "the Commission") held its first meeting in Washington, D. C., on September 29, 1955, and two subsequent meetings. In its deliberations, the Commission explored the following questions:

1. Should the Federal Government continue its present program of rubber research?
2. What recommendations does the Commission wish to make, arising out of its consideration of the first question, for continuing Government research activities?

In the conduct of its inquiries the Commission sought the views of the following, among others: (a) University and other scientists engaged in research in rubber and other elastomers; (b) an ad hoc Panel on Rubber Research which had been providing scientific advice to the National Science Foundation regarding the composition of the current rubber research program; (c) rubber, chemical and oil companies; and (d) Federal agencies, including the Department of Defense, National Bureau of Standards, and the Department of Agriculture. Continuing liaison was maintained with the Office of Defense Mobilization.

CHAPTER I

HISTORICAL DEVELOPMENT OF THE GOVERNMENT'S RUBBER RESEARCH PROGRAM

A. HISTORY OF THE SYNTHETIC RUBBER PROGRAM IN GENERAL

1. Origin of the Program

The Government's research and development program in synthetic rubber, like the entire synthetic rubber industry, was a product of the wartime shortage of natural rubber. Prior to the war, the Government had moved to offset this shortage. In 1940 the Rubber Reserve Company, a subsidiary of the Reconstruction Finance Corporation, was established to stockpile natural rubber. Immediately after Pearl Harbor this agency was assigned responsibility for developing a full-scale synthetic rubber industry. A basic patent agreement, the first of several to follow, calling for an exchange of technical information and making all patents available for general use, was negotiated between the Government and the major companies interested in synthetic rubber.

The program, complete with plant designs, was inaugurated promptly, but construction lagged. To study the difficulties impeding its progress President Roosevelt, in the summer of 1942, appointed a Rubber Survey Committee, consisting of Bernard Baruch, Chairman; James B. Conant and Karl T. Compton. In response largely to this Committee's recommendations, all administrative aspects of the program were concentrated in an Office of Rubber Director, nominally responsible to the Chairman of the War Production Board, but with broad authority to act independently.

The principal concern of the Government was with priorities, allocations, production facilities, etc. But the Government also developed, based on the recommendation of the Baruch Committee, a coordinated three-part program of research and development in rubber. The first part was a research program in synthetic rubber, to be programmed within the Office of Rubber Director and carried out through contracts with nonprofit research institutions and industrial concerns. Secondly, the Department of Agriculture was to carry on, through its own resources and those of the various State Experiment Stations, research in the production of natural rubber from plants which could be grown in this country, notably the guayule shrub and the Russian dandelion. Thirdly, an effort was to be made to develop the cultivation of the hevea tree (the source of Far Eastern rubber) in Central and South America to the point of significant productivity. Responsibility for this effort was eventually centered in the Rubber Development Corporation, a subsidiary of RFC.

The synthetic rubber research program was transferred to the Rubber Reserve Company when the Office of Rubber Director was abolished in September 1944. Neither of the other two efforts produced significant results.

By 1945, the objective of building a synthetic rubber industry had been accomplished. Fifty-one plants, with a combined annual production capacity of 1,100,000 long tons had been built at a cost of approximately $700,000,000. At the war's end, these plants were supplying 85 per cent of all the new rubber consumed in the country. While built and owned by the Government, these plants had from the beginning been operated for the Government's account by private companies under contract.

The research and development program was also well under way. Through the war period, efforts had been directed largely toward improvements in plant processes

and equipment to minimize the consumption of critical raw materials and to increase the production and to maintain the uniformity of a generally satisfactory synthetic rubber.

2. The Interagency Policy Committee on Rubber, 1945

Upon the termination of World War II, the Government faced the problem of what to do with the new industry. Although some types of synthetic were superior to natural for certain limited uses, it was expected that natural rubber could be produced more economically. As a consequence, natural rubber would, as soon as Far East plantations could be brought to full yield, replace synthetic in an uncontrolled market. To consider the problem, the Director of the Office of War Mobilization and Reconversion established in September 1945, an Interagency Policy Committee on Rubber, under the chairmanship of William Batt, and composed of representatives of the various Governmental agencies having an interest in rubber policy.

In its reports, the Committee reasoned that the Nation's security required that the synthetic rubber industry be maintained. To this end it recommended that legislation be enacted continuing specification, inventory and allocation controls in order that the Government could insure at least the minimum consumption of synthetic deemed necessary to support sufficient synthetic rubber production for national security. It further recommended that the Government's production facilities be sold to private industrial concerns subject to certain considerations, that those not sold (with certain exceptions) should be retained in stand-by status by the Government, and that the Government should stockpile natural rubber.

With respect to research and development, the Committee declared itself "...impressed with the necessity of supplying all possible incentives to future conduct of research in the rubber field, so that the objective may be attained of maintaining without artificial support a synthetic rubber industry adequate for national security."[1] It also recommended that, "Broad research programs for quality and cost improvements in the synthetic rubber field should be continued by Government and private industry."[2] In elaboration of this recommendation the Committee sought a proper division of research effort between the Government and private industry, analyzing the problem as follows:

(a) Research in end products--should be supported entirely by private industry.
(b) Research in new polymers--applied research and development in new polymers should be supported by private industry; long-range basic research, by the Government. With respect to the latter, it suggested further that "Projects of this kind could best be supported by some national research foundation of the type now being considered by the Congress,"[3] i.e., the National Science Foundation.
(c) Research in processing techniques--should be supported by private industry.
(d) Research in natural rubber--should be continued by the Department of Agriculture.

3. The Rubber Act of 1948

No immediate legislation dealing with rubber policy resulted from the Interagency Committee's report. As supplies of natural rubber increased, its price dropped below that of synthetic and the Office of Rubber Reserve of the RFC[4] began transferring plants to a stand-by status. Under the Surplus Property Act of 1946 as well as the Rubber Act of 1948, authority was included for the sale of plants provided a proposed sale was not disapproved by joint resolution of the Congress within 30 days after negotiations had

[1] "Report of Interagency Policy Committee on Rubber", July 1946, quoted from Hearings before Subcommittee of the Committee on Banking and Currency, U. S. Senate, on S. J. Res. 79, H. J. Res. 77, and S. J. Res. 83 on Rubber Production and Importation Policy, March 11, 1947, p. 34.

[2] Ibid., p. 12.

[3] Ibid., p. 30.

[4] In 1945 the Rubber Reserve Co. ceased to exist as a separate corporate entity and its operations and staff were integrated with the parent corporation.

been completed and notice given to the Congress. Under this authority, 18 plants were sold from 1946 through 1949 when the sales were discontinued. Most of the plants sold however, were obsolescent, or suitable only for miscellaneous production. The core of the country's productive capacity was left in Government hands.

The need for policy decisions and legislative action became acute in early 1947 with the Second War Powers Act, under which the program had been developed, due to expire on March 31 of that year. Committees of both Houses held hearings in February and March 1947 on new rubber legislation. But time was too short to develop comprehensive legislation. Special legislation was passed merely extending for one year the authority of the Second War Powers Act insofar as it applied to rubber.[5] In the summer and fall the Committees held extensive hearings on the whole problem. The result was the Rubber Act of 1948, passed in March, 1948.[6]

The act declared it to be the policy of the Government to transfer ownership to private hands and to end all controls as soon as national security permitted. Pending such a transfer the President was authorized to continue allocation, specifications, and inventory controls to the extent required to insure consumption of a certain specified quantity of synthetic annually, to continue operation of Government-owned plants, and to perform certain other acts not germane to this discussion. The conduct of "...continuous and extensive research by private parties and the Government" was declared essential to a technologically advanced rubber industry, and the Government was authorized to conduct such research. Finally, under the Act, the agency designated by the President to operate the Government plants (the RFC was so designated by E. O. 9942) was directed to prepare a disposal plan for submission to the President and the Congress by April 1, 1949. The President in turn, after consultation with the National Security Resources Board, was to recommend to Congress by January 15, 1950, necessary legislation for carrying out any disposal plan he deemed advisable.

4. The 1950 Disposal Plan

Pursuant to the 1948 Act, the RFC submitted its disposal plan in April 1949.[7] President Truman asked John R. Steelman, the Assistant to the President, and then Acting Chairman of the National Security Resources Board, to study the RFC plan and prepare recommendations based upon it. Dr. Steelman held extensive discussions with representatives of 14 agencies having an interest in the matter and submitted his recommendations in January, 1950. The President transmitted these to the Congress in a message on January 14, stating they had his approval.[8]

The report recommended continuation of most of the controls then in effect. It set forth a number of general principles to ensure that in disposing of the plants a minimum level of production capacity would be maintained and maximum competition fostered. Among other things, it suggested that each disposal contract be subject to a "National Security Clause", requiring such maintenance of plant and equipment as the Government determined to be necessary.

Relative to the research and development program the report recommended as follows:

> "...It is recommended that the Government's authority to conduct research in synthetic rubber continue. When the plants are privately owned, there should be a stimulus to research in manufacture and particularly in utilization of synthetic rubber on the part of these private interests, so that the Government's partici-

[5] P.L. 24, 80th Cong.

[6] P.L. 469, 80th Cong., 50 USC 1921-1938

[7] Report with Respect to the Development of a Program for Disposal of the Government-Owned Rubber Producing Facilities, Reconstruction Finance Corporation, April 1, 1949.

[8] The President's message and Dr. Steelman's report are contained in a document, Synthetic Rubber, Recommendations of the President, January, 1950. (Transmitted to the Congress together with a report from the Assistant to the President on Maintenance of the Synthetic Rubber Industry in the United States and Disposal of Government-Owned Synthetic Rubber Facilities.)

pation in research in these areas may be substantially reduced. On the other hand, because of the importance to national security of the development of new or improved synthetic rubbers which can completely replace natural rubber in essential military and civilian applications, it is believed that the Government should have authority to carry on a substantial program of research directed toward this objective.

"The Government-owned evaluation laboratory at Akron provides valuable service to both private industry and the Government, and should be continued in operation by the Government. So long as the Government is actively engaged in the manufacture of synthetic rubber, the Akron research facilities should be continued on the present basis. Thereafter, authority should be continued to retain these facilities and use them primarily in connection with research conducted in rubber and related fields by the various military and civilian agencies of the Government."[9]

The Congress again considered the subject in the spring of 1950 but reached no definite conclusions. It extended the Rubber Act of 1948 to June 30, 1952, requiring submittal of a new disposal plan and legislative recommendations.

5. History 1950-1955

With the outbreak of the Korean War in June 1950, the question of disposal for the time being became irrelevant. The price of natural rubber on the world market skyrocketed, jumping from around 20 cents per pound in January 1950 to over 70 cents in November of that year. To offset this increase the Government began reopening stand-by plants and tightening up on the operation of controls. Because of the unsettled conditions, little thought was given to getting the Government out of the rubber business.

As the mobilization effort got under way and the effects of the Government's increased production of synthetic began to be felt, some semblance of equilibrium returned to the rubber market. Natural rubber prices began dropping back toward the price of synthetic. By the summer of 1951, it was apparent that the country was capable of producing all the rubber it might need in an emergency, and perhaps even more. Interest in disposal of the facilities revived.

When the extension of the Act came up for debate in the Congress in the spring of 1952, there was general agreement that the production facilities should be turned over to private industry, but it was felt that the action was too complicated to be undertaken in a short period. The Act was extended to March 31, 1954, and the President was again requested to submit a disposal plan by March 1, 1953, and implementing legislation by April 15, 1953.[10] Subsequent legislation and other developments concerning the disposal of rubber producing facilities have been sketched in the preface to this Report.

B. EVOLUTION OF THE RESEARCH AND DEVELOPMENT PROGRAM

1. Objectives and General Characteristics

The general objectives of Government-sponsored research and development in synthetic rubber were to make synthetic rubber better and cheaper and to produce it more efficiently. Perhaps the best known product of the program was the development of "cold rubber", a modified type of GR-S synthetic rubber[11] produced at lower temperatures which can be compounded into tires for passenger car service to give a treadwear better than natural rubber. A later development was the process of oil-masterbatching, which promised further improvement in wearing qualities and economies in production. In addition there were innumerable minor improvements.

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[9] Synthetic Rubber, Recommendations of the President, January, 1950, pp. 62-63.

[10] P. L. 404, 82nd Cong.

[11] "GR-S" refers to general purpose synthetic rubber composed of butadiene-styrene copolymer used largely in tires. "GR-I" refers to a special purpose synthetic rubber composed of isobutylene-isoprene copolymer, used largely for inner tubes.

From the beginning, the administrators of the program considered that continuing basic research in polymers and related chemical subjects was essential to progress in applied research or development. They fashioned a program in which the effort was made to relate basic research closely to the applied and developmental phases. Just prior to the disposal of the rubber plants in early 1955, the research programs consisted of four parts or groupings of activities, as follows:

(a) Studies conducted under contract with the Federal Facilities Corporation by educational and research institutions, a private research firm, and the National Bureau of Standards. For general administrative purposes, FFC personnel had classified this work as basic, although they conceded that some of it was applied research.
(b) The Government Laboratories, operated by the University of Akron under contract with the FFC. While the Laboratory initiated some work itself, it was engaged principally in developing the production characteristics and feasibility of new polymers which had been originated in the institutional research program, or by the operators of the producing plants or by private groups.
(c) Applied research and development conducted under contract with FFC by the agent-operators of the various facilities. The work was principally directed to improvements in manufacturing processes and in end products.
(d) Government tire testing activities conducted under contract with FFC. These tests were carried out on roads in the vicinity of San Antonio, Texas, under conditions specified by FFC and with tires built from experimental polymers developed by FFC.

2. Administration

As of April, 1955, the entire rubber program was administered within FFC by the Office of Synthetic Rubber. A Division of Research and Development within this Office had responsibility for the research and development phase of the program. A Rubber Industry Advisory Committee composed of top industry representatives, such as presidents of rubber-producing companies, advised the Office of Synthetic Rubber on the over-all aspects of the rubber program. Another committee, composed of research directors, vice-presidents in charge of research, etc., advised the Research and Development Division on the research program.

All contractors under the program, both university and agent-operators, customarily presented in the spring of each year their suggestions for work to be done during the following fiscal year. These suggested programs were reviewed by the Research and Development Advisory Committee and by the staff of the Research and Development Division. The Division's staff made the final determinations as to the program for each contractor during the budget year, adding to or making such modifications in each contractor's suggested program as it deemed desirable.

3. Financing

The RFC and FFC financed all costs of the research and development program out of proceeds from the sale of synthetic rubber manufactured in Government plants. Although the Rubber Act of 1948 authorized separate appropriations for research and development, RFC never saw fit to request such appropriations.

For the fiscal year 1955, the program was estimated at $4,160,000. The estimated cost of each of the four segments of programs for fiscal 1955 was as follows:

	Amount	% of Total
Universities and other non-agent contractors	$990,000	23.8
Agent-operators of production plants	2,005,000	48.2
Government Laboratories (U. of Akron)	950,000	22.8
Government tire testing	215,000	5.2

4. Contractual Arrangements

All the research and development work sponsored by RFC and FFC was carried on through individual cost-type contracts with each of the institutions or agent-operators participating in the program. For each of these there was a basic contract covering the general business arrangements to which was added an amendment for each fiscal year setting forth the work to be done and the budgetary limitation. The contracts with the universities covered direct costs of the work plus a negotiated indirect cost allowance; those with profit-making organizations included in addition a fixed fee for managerial services. Title to all equipment purchased under the contracts was vested in the Government and records of this equipment were maintained by the FFC Comptroller. When contracts were terminated, the FFC sought to transfer the equipment to other contractors, with the balance generally sold to the institution.

5. Patent Arrangements

The patent arrangements of the wartime development of synthetic rubber rested on a series of agreements by the Government with the various rubber producers providing for a pooling of patent holdings and a free exchange of technical information. The first of these was negotiated in December 1941, and was followed during the next few months by a series of additional agreements covering copolymerization processes and the production of various feedstocks. The original multilateral agreements were generally replaced after the war by bilateral agreements between the Government and the individual companies. Generally, these agreements permitted the transfer on a royalty-free basis of technical information, whether patented or unpatented, growing out of the operation of Government-owned plants, to Government nominees such as plant purchasers.

Agreements between the Government and each of the university research contractors provided, with respect to inventions and patents in individually defined fields, that RFC had the right to file patent applications on inventions arising from the research and to administer any patent rights accruing to it. RFC generally followed the policy of dedicating inventions resulting from the program to the public through publication without patenting.

CHAPTER II

THE PRESENT RUBBER RESEARCH PROGRAM

Since July 1, 1955, research in synthetic rubber has been supported by the Federal Government in two ways. First, the constituent military agencies of the Department of Defense have continued to carry on, as in the past, research programs on rubber and rubber products as they relate to military usage. Such research projects are conducted within the laboratories of the Armed Services and by contract with universities, industrial firms and other groups. These programs and projects have not been examined in any detail by the Commission.

Second, the Federal Government, through the National Science Foundation, supports (a) a program of rubber research conducted by universities and other research organizations under contract with the Foundation, and (b) the activities of the Government Laboratories at Akron, carried on under a management contract between the University of Akron and the Foundation. The estimated total cost of both phases of the NSF research program for the fiscal year ending June 30, 1956, is approximately $2,000,000.

A. RESEARCH CONTRACTS

Following are set forth the scope of work and estimated annual costs of research contracts presently being financed by the National Science Foundation in the field of synthetic rubber.

1. University of Akron — $50,000

   Emulsion Polymerization--Studies of: controlled cross-linking of polymer chains by including co-monomers in regular emulsion systems thus introducing reactive functional groups and yielding vulcanizates having improved hysteresis properties suitable for tire carcass stocks; and, post-polymerization changes in molecular weight, gelation, etc., occurring in emulsion polydienes as well as molecular weights of emulsion polymers formed at very low conversions (below 3%) to determine effects of initiators and modifiers.

   Bulk Polymerization--Study of kinetics of free radical bulk polymerization of dienes to determine value of termination rate constants for these monomers.

   Graft Polymers--Study of preparation and properties of synthetic graft polymers to determine value of such elastomers in tire carcass and in dipped and foamed products and the effect of compounding ingredients.

   Emulsifier-free Polymerization--Study of latexes prepared without emulsifiers to ascertain influence of added protein, resin, and wetting agents on adhesiveness to fabric and determine suitability for preparation of dipped and foamed products.

   Polymer Adhesion and Cohesion--Study of special polymer adhesiveness and cohesiveness for developing tire constructions of improved resistance to ply separation.

2. Burke Research Company — $150,000

   Research directed toward the improvement of synthetic rubber for the manufacture of heavy duty tires and of tires for passenger vehicles with emphasis

on the following two approaches: (a) improvement of the low hysteresis elastomer; and, (b) improvement of the reinforcing agent.

Research on polybutadiene and butadiene-styrene copolymers produced by Alfin catalyst polymerization in a continuous system, using a one liter reactor.

Research on reinforcing agents, prepared from cross-linked vinyl materials with proper surface reactive groups, which, when incorporated into GR-S stocks, give improved tensile strengths and low heat build-up.

3. Case Institute of Technology $70,000

Investigation and definition of the fundamental physico-chemical properties of synthetic latices and polymer solutions, particularly with reference to flow behavior.

Development of more refined methods and improved types of instrumentation for evaluating the physicochemical properties of latices and polymer solutions.

4. University of Chicago $55,000

The mechanism of the scission of carbon--carbon bonds by light and oxygen in the presence of additives.

Extend the use of altered nature of products formed in a given free radical reaction, using "free radical trappers" which stabilize free radicals, to the polymerization and copolymerization of monomers which may effect improvements in properties of a copolymer yielding a polymer of high intrinsic viscosity.

Attempt to introduce directly certain functional groups into preformed polymer molecules and to condense these groups with appropriate bifunctional compounds.

Develop methods for the stabilization of monomers in the vapor stage and in storage.

Continue basic research on free radical mechanisms of reaction.

5. Cornell University $20,000

Elucidation of the stepwise mechanism in the transformations through which natural rubber is synthesized in latex-bearing plants with the objective being an attempt to uncover fundamentally different new ideas and methods which may lead to development of novel approaches to synthetic rubber.

Determination of the fate in latex-producing plants of various isoprenoid intermediates which have been synthesized and which contain carbon-14 as a verification as to whether or not they are concerned in the biosynthesis of rubber.

6. Cornell University $68,000

Determine the molecular structure of polymers in their different physical forms and the relation of such structures to over-all mechanical or electrical properties.

Study of various polymers subjected to measurement of their osmotic pressure, heat of fusion, viscosity, light scattering, rate of crystallization, stress-strain-temperature reaction, dielectric high frequency effects, field-induced diffraction, etc.

Study of molecular weight and molecular weight distribution which may provide fundamental data on which to base necessary theories of polymerization and the properties of polymers.

7. University of Illinois $135,000

Preparation of new polymers which may: (a) meet the requirements of the Department of Defense; (b) have the low hysteresis values required in large truck tires; and (c) be stable at high temperatures. In addition, seek knowledge concerning the relation between the structure of polymers and their properties using the approaches of organic and physical chemistry.

Attempt the synthesis of the thermostable polymers using chelate complexes of phenolic Schiff bases containing divalent metal ions of zinc, copper, nickel, and iron.

Active follow-up of encouraging results obtained in the synthesis of copolymers from butadiene and analogs of benzalacetophenone which show low heat build-up.

Preparation of other new polymers which may possess oil-resistant properties.

Physical chemical investigations directed to obtaining knowledge of the properties of macromolecules in solution with particular reference to the dimensions of polymers and the physical interactions between polymer molecules, as an aid toward design of the best possible elastomers.

8. Massachusetts Institute of Technology $105,000

Study of new methods of metalation which would simplify preparation of the catalysts.

Study the effect of associated salts upon reactions induced by sodium and sodium reagents.

Study the changes in the type of polymer caused by changes in the composition of the catalysts and investigate the catalysts and conditions for preparing Alfin polymers which can be handled by present methods of compounding.

Studies during the first half of the period will be conducted by Godfrey L. Cabot, Inc., of Boston, Mass., under a subcontract to determine whether Alfin polymers can be handled successfully by industry providing proper care is given to details.

9. Mellon Institute of Industrial Research $109,000

Development and application of methods for the determination of the structure of synthetic elastomers.

(a) X-ray and birefringence studies of crystallinity and orientation in synthetic elastomers.

(b) Determination of molecular weights and dimensions by osmometry, light-scattering, and viscometry for analytical purposes and for estimating the degree of branching.

Development and application of methods for investigating the physical properties of polymers.

(a) Study of low frequency dynamic behavior of solid polymers with a major objective of assessing effect of structure, molecular weight, extent of cross-linking, fillers, etc., on the dynamic loss factor.

(b) Rheological investigation of polymers and their concentrated solutions in an attempt to better understand fundamental properties underlying processing characteristics and industrial physical tests.

10. University of Minnesota $80,000

Study of effect of the kind and amount of hydroperoxide on polymerization.

Study of modification of polymerization by means of high molecular weight mercaptans.

Study of mechanism of action of retarders.

Study of role of persulfate in polymerization.

11. National Bureau of Standards $194,000

Determination of the thermodynamic functions of rubber solutions including vapor pressures and densities.

Measurement of elastic and flow properties of elastomers and polymer solutions as a function of molecular weight distribution.

Mechanical degradation.

Thermal stability of elastomers.

Thermochemical energies for various molecular structures.

Composition and properties of components of rubber-processing oils.

Kinetics and heat of vulcanization of rubber compounds.

Development of methods for the evaluation of polymers, using infrared and ultraviolet spectroscopy.

Study of the influence of tread and carcass composition on the power loss and operating temperature of tires.

B. GOVERNMENT LABORATORIES, AKRON

In accordance with decisions by the Office of Rubber Director, the facility known as the Government Laboratories was constructed in 1943 by the RFC. The eventual construction costs amounted to somewhat over $2,000,000. During the period 1944-55, the Laboratories comprised one of the principal research and pilot plant components of the synthetic rubber industry as operated for the Government during those years.

The present net book value of the Laboratories is approximately $545,000.

The Facility is located at 351 West Wilbeth Road in Akron and adjoins one of the plants of the Firestone Tire and Rubber Company. The Facility comprises an office and laboratory building, a pilot plant, and service buildings, all of which are fully equipped and furnished.

The Laboratories are equipped to conduct research studies on polymerization and to prepare polymers and copolymers in dry or latex form in quantities up to 500 gallons (700 pounds) per single reactor batch or by continuous process. They are adapted to conducting polymerizations in emulsion systems such as the GR-S process and are experienced and equipped to conduct mass and bulk polymerizations also. They are also adapted to testing the possibilities of new raw materials, such as monomers, soap, modifiers, shortstops or catalysts for the GR-S type of synthetic rubber process.

The Laboratories are also equipped to conduct full evaluation and processing tests of elastomers, including determinations of Mooney viscosity, solution viscosity, gel, stress-strain measurement at normal and elevated temperatures, low-temperature flexibility (Gehman), laboratory Banbury, mill processing and extrusion tests, flexometer (temperature-rise), De Mattia, styrene content and chemical tests of butadiene-styrene copolymers.

The Laboratories are presently operated by the University of Akron under a management contract with the National Science Foundation. In fact, the University has operated the Facility for the Government since January 1, 1944. Under the present contract, the University is reimbursed for all costs incurred and is paid a yearly management fee of $50,000. The Laboratories are managed as an operation separate from the University's educational program.

The operating costs for the Laboratories will approximate $950,000 for the fiscal year ending June 30, 1956. A summary of the estimated budget for the 1956 fiscal year, broken down as among categories of expenditures and nature of projects is set forth below.

Categories of Expenditure:

Salaries and wages	$662,400	
Overhead	160,800	
Materials & supplies	80,800	
Capital items	46,000	
Total		$950,000

Nature of Projects:

Latex	$30,000	
Black masterbatches	1,000	
Oil masterbatches	109,000	
Physical structure, etc	176,000	
Practical variations	234,400	
Polymerizations below 41° F	1,000	
Monomer variations	30,400	
Special catalysts (sodium & alfin)	129,900	
Chemical engineering & instrumentation	500	
Other, including work for university contractors.	207,800	
Capital items, not allocated to projects	30,000	
Total		$950,000

The following Facility services are obtained from the adjacent Firestone plant under a subcontract between the University and the Firestone Company: (a) police and fire protection; (b) steam; (c) water connections for firefighting; (d) butadiene and styrene; (e) sundry chemicals; and (f) medical examination and first-aid services.

The Laboratories function as a member of the "research team" which carries out the present rubber research program supported by the Government through the National Science Foundation. The activities of the Laboratories are largely of an applied and developmental character. Some of its work is directed toward the servicing of the university contractors, but this is a relatively small portion of its total effort. Following cessation of Governmental manufacturing operations as the synthetic plants were transferred to private hands, the Laboratories have been concerned primarily with work on special projects suggested by the Department of Defense and recently with the solicitation of contract work to be undertaken for private industry. The projects being carried on for the Department of Defense produce no income for the Laboratories. They constitute the utilization by the Department of capacity at the Laboratories which would not be otherwise utilized by the Government.

C. ADMINISTRATION OF THE RESEARCH PROGRAM

The research program is administered centrally by the Rubber Research Group of the National Science Foundation. The Head of the Group, Mr. Paul S. Greer, reports to the Deputy Director of the Foundation and is responsible for giving direction to the University contractors and to the University of Akron as manager of the Government Laboratories. From 1950 until July 1, 1955, when the research program was transferred to the Foundation, Mr. Greer served as the Chief of the Research and Development Division of the Office of Synthetic Rubber, RFC and FFC. Two other technical staff, formerly with FFC, Dr. T. H. Swan and Mr. W. W. Rinne make up the Group.

CHAPTER III

RESPONSIBILITY OF THE FEDERAL GOVERNMENT FOR FUTURE SUPPORT OF BASIC RESEARCH IN RUBBER AND RELATED ELASTOMERS

A. THE NEW SITUATION

The Commission is unanimously and strongly of the belief that increasing support of fundamental research by the Federal Government is essential to the national interest. The need for increased emphasis upon and support of basic scientific research is so widely recognized and accepted by industrial leaders, scientists, and educators in the United States as to require no further exposition by this Commission. However, this Commission believes that it is also supported by most scientists, industrialists and university administrators in expressing the conviction that funds for the Governmental support of basic research should not be requested from the Congress for specific industries or commodities, in the absence of overriding considerations of defense or other special national interests.

The Commission finds no such compelling considerations in the rubber industry. The present situation is that synthetic rubber production has passed into private hands. The purchasers include a large number of strong competing industrial groups having very able applied science research organizations. The program of Government-sponsored research projects no longer forms part of this industrial complex. On the contrary, the former intimate relations of the Government research projects to the productive industry operated by the Government are now replaced by the normal relation between Government technical activities, all results of which are necessarily public property, and the competitive, proprietary, and largely confidential technical activities of privately owned industrial units. The Rubber Producing Facilities Disposal Commission recognized that the Government rubber research program would have to be re-examined after such a change. The first conclusion of this Commission is that the circumstances have changed so radically that the best start is to complete the withdrawal of the Government from the rubber industry and examine with an open mind the present and future needs, if any, for Government-supported basic research relating to synthetic rubber.

In reaching this conclusion, the Commission has not overlooked the report of the Rubber Panel of the Materials Advisory Board, issued just prior to the disposal of the synthetic rubber plants in early 1955.[2] This report was prepared under the auspices of the National Academy of Sciences--National Research Council in response to a request of the Department of Defense for "an advisory report containing recommendations concerning the future needs of the Department of Defense for a research and development program on rubber."

The MAB Panel outlined three problem areas requiring expanded research efforts: (1) synthetic rubber or rubber-like materials possessing properties to meet the operational requirements of present and future weapons systems; (2) synthetic rubbers or rubber-like materials for use in tires for high speed aircraft; and (3) synthetic rubbers or rubber-like materials to replace natural rubber completely. Problems in the first two categories are directly related to the defense mission. The Commission believes that research on such problems directed toward specified end products needed by the military agencies, whether called "basic research" or "applied research", is most appropriately carried on through contracts placed by the Department of Defense

[2] Report on Rubber, Panel on Rubber of the Materials Advisory Board, National Research Council, National Academy of Sciences (under Contract DA-49-025-sc-83 between Department of Defense and National Academy of Sciences), January 17, 1955.

with individuals or groups chosen by it, and the Commission knows of no good substitute for this direct action.[13]

The Commission gave special consideration to the third problem area identified by the MAB Panel as requiring an expanded program of Government-supported research--"Synthetic rubber or rubber-like materials to replace natural rubber completely." However, the production of a natural rubber substitute is now an industrial development problem rather than a research problem. The Commission is advised that subsequent to the preparation of the MAB report, the Goodrich, Firestone, and Goodyear companies have each succeeded independently in synthesizing material with composition and properties similar to natural rubber, using isoprene as raw material.[14] Isoprene, like the butadiene needed for GR-S rubber and the isobutylene needed for GR-I rubber, can be made from petroleum in any necessary quantities, although much time will be required to complete the details of the industrial production methods, to integrate most economically any large new production of isoprene with other phases of the oil and petrochemical industries, and to build the new equipment needed. The initial estimates of production cost are within the range of recent prices of natural rubber.

The Defense Department and the Office of Defense Mobilization will doubtless examine the prospects for supplies of natural rubber substitute made by the new processes directly with the three companies, and perhaps with other industrial units, and will reach their own conclusions in due time; but prima facie, the natural rubber substitute problem is now an economic and industrial problem rather than one requiring Government-sponsored scientific research. Economic conditions may provide an environment under which commercial development of the new processes for making natural rubber substitute will move forward without any Governmental action. If not, such an environment can be created by appropriate Governmental action which may be either legislative or executive and may take any one of a number of different forms. Similar questions were considered and debated extensively in the years preceding the war rubber crisis of 1941. When action was finally taken there was no alternative to the immediate creation of a Government synthetic rubber industry. During the preceding years, however, it was the absence of a favorable economic environment, not the lack of scientific research data, which prevented the building up of a privately owned synthetic rubber industry. Under wartime conditions that industry was found to be technically capable of supplying 85% of the Nation's new rubber requirements, civilian and military. Under present peacetime conditions the Commission is informed that about 30% of the civilian and military consumption is natural rubber rather than any of the synthetic products now in commercial production.

Concluding its consideration of the need for research on a natural rubber substitute, the Commission finds that Government-sponsored research is no longer necessary to provide a foundation for this industrial development. However, the Commission believes that an important consideration bearing upon national security may still exist, and the Commission wishes to make it clear that its finding that there is no need for Governmental research does not mean that no Governmental action in this industrial area is desirable. On the contrary, the Commission feels impelled to recommend that the Government, at its highest levels, give immediate consideration to the following question: Does the national security require Governmental action to foster the industrial development of the new processes of synthesizing "natural rubber"?

[13] This concept is exactly in accord with the provisions of Executive Order 10521 issued by President Eisenhower on March 17, 1954--Executive Order Concerning Government Scientific Research, The National Science Foundation, and The Interdepartmental Committee For Scientific Research and Development. Section 4 of the Executive Order reads: "As now or hereafter authorized or permitted by law, the Foundation shall be increasingly responsible for providing support by the Federal Government for general-purpose basic research through contracts and grants. The conduct and support by other Federal agencies in areas which are closely related to their missions is recognized as important and desirable, especially in response to current national needs, and shall continue."

[14] B. F. Goodrich Company: "Ameripol SN-A Synthetic Cis-Polyisoprene" and Firestone Tire and Rubber Company: "A Cis-Polyisoprene Having the Molecular Structural Features of Hevea Rubber", both papers presented at Sixty-eighth meeting of the Division of Rubber Chemistry, American Chemical Society, Philadelphia, Pa., Nov. 3, 1955. Goodyear Tire and Rubber Company: "Synthesizing 'Natural' Rubber", Chemical and Engineering News, October 24, 1955.

B. NEED FOR FUNDAMENTAL RESEARCH IN HIGH POLYMERS

The name polymer (i.e., many parts) has been given to a class of substances whose molecules are structures built up from repeating units and have high molecular weight. The importance of basic research in the field of polymers can be appreciated when it is realized that they are essential substances in the existence of life in the vegetable and animal kingdoms. Elastomers, resins, and fibers, whether natural or synthetic, are examples of polymers. The rubber, plastics and textile industries therefore depend upon polymers. Elastomers are polymers having elastic properties and exhibiting a relatively large elongation without failure under stress.[5]

The Commission believes that the most effective method of arriving at entirely new structural materials, whether they be rubber-like materials or, more generally, elastomers of improved properties, or other forms of polymeric materials, is to expand basic research on molecular structure and arrangement, composition, and properties, and methods of preparing such materials, all as they affect such special properties of matter. This is a scientific area which lies at the interface of chemistry and physics. It is much broader than any single industry or any one of the specialized scientific disciplines. The Commission believes that explorations by basic research in this area are the best possible foundation both for new industries and for new military developments. Applied science and industrial research require more and better information in this broader area rather than continuation of the present program of mixed basic and applied research on synthetic rubber.

Some of the sponsored projects within the present rubber research program being administered by the National Science Foundation seem to lie very near to the recommended new program, and some of the scientists now engaged in projects of a more applied character will undoubtedly wish to undertake researches in the more basic area. It is therefore clear that important human and scientific assets built up by the past Government rubber research program could be utilized in the recommended program.

Expansion of the more fundamental or basic type of research, such as here recommended, is, by general agreement, a field in which it is important for the Federal Government to increase its activities. It is also a field in which the National Science Foundation is without doubt the proper agency of the Government to administer expenditures on a continuing basis.

The Commission therefore recommends:

1. **The present program of Government-sponsored rubber research projects, costing about $1 million per annum and now temporarily administered by the National Science Foundation, should be regarded as terminated at the end of June 1956.**
2. **In place of this program, the National Science Foundation should support a new and more basic program made up of research projects in the general area of molecular structure and arrangement, composition, and properties of high polymers, particularly elastomers, and methods of preparing such materials. To inaugurate this new program in the most effective way and to conserve the human and scientific assets developed under the former rubber research program, the Commission recommends that special funds be made available to the National Science Foundation for the 1957 Fiscal Year, during which the Foundation would wind up the old program, absorbing such parts of it into the new program as appropriate.**

The Commission is unanimously and firmly of the opinion that generous and expanding support of basic research is called for by every consideration of national interest.

The Commission has not attempted to prejudge the dollar amount of new research which the Foundation will find it desirable to support either during the 1956-57 transition period or thereafter. This must be a Foundation decision arrived at only after detailed examination of the field and of its relation to other fields of basic research and of the research talent available.

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[5] D'Alelio, G. F., Fundamental Principles of Polymerization--Rubber, Plastics and Fibers, 1952.

CHAPTER IV

DISPOSITION OF THE GOVERNMENT LABORATORIES

A. QUESTIONS

In considering the manner in which the future use or disposition of the Government Laboratories would best serve the public interest, the Commission was confronted with a variety of concepts and alternative courses of possible action.

Before addressing itself to the possible alternative courses of future disposition of the facility, the Commission undertook to get facts and informed opinions from the segments of industry, government and science most likely to be concerned with the availability of the Laboratories in the future.

First, a sampling was obtained from a cross section of the rubber, chemical and related industries and research institutes, by a questionnaire (Appendix A). Through this inquiry the Commission endeavored to learn:

1. The extent to which the Laboratories comprise unique equipment and competence not available elsewhere.
2. The extent of interest, if any, among industrial companies in either acquiring the facility through purchase or lease or in utilizing the facility on a contractual basis for the performance of research, evaluation, testing or pilot plant polymerization work.
3. The extent to which work which industry would like to have done at the facility is tied into national defense contracts.

Second, the Commission solicited the views of those Government agencies whose activities were closely related to the Laboratories, in an effort to determine the extent to which such governmental activities and interests would be handicapped or prejudiced if the Laboratories became unavailable for use by the Federal Government. Views and recommendations were obtained from the Department of Defense, the National Bureau of Standards, and the Department of Agriculture.

Third, the university and other scientists engaged in the present Federally supported research program in synthetic rubber were queried as to the effect upon their research endeavors which would result should the services of the Laboratories become unavailable to their use in evaluation and preparation of experimental polymers.

Finally, due to its long and successful tenure as the contractor-manager of the Laboratories for the Government, the University of Akron was invited to submit its views and recommendations to the Commission.

B. FINDINGS

As a result of the foregoing inquiries, the possible courses of action which the Commission might wish to recommend seemed clear. These findings were as follows:

1. Some interest in the facility exists in the rubber and chemical industries and among research institutes, both in terms of acquisition or utilization on a contractual basis.

Of 138 firms addressed, 81 responded. Of the respondents, 46 expressed no interest in the facility, while 35 indicated some interest. Of the latter 9 were interested

in possible acquisition through purchase or lease, 29 were interested in utilization on a contractual basis, and 3 expressed possible interest in both.

The foregoing information, supplemented by various informal conversations, leads the Commission to conclude that if the Government Laboratories were placed under a disposal program such as that conducted by the Rubber Producing Facilities Disposal Commission, sale at some substantial price might be effected.

2. No apparent current interest exists in the rubber industry in the direction of forming an industry-wide research institute which might utilize the Government Laboratories in connection with an industry-sponsored research program.

No such industry-wide group exists at the present time, and as far as the Commission knows, no plan is under consideration for establishing such an organization.

3. The Government Laboratories have large-scale pilot plant facilities; these are not unique in the rubber industry, but could be useful from time to time to organizations interested in research and development work on elastomers and other polymers. The other facilities of the Laboratories are common to many commercial testing laboratories, and little difficulty would be experienced by research scientists in obtaining these services on a contractual basis were the Laboratories not available.

To estimate the importance of accessibility to the Government Laboratories, the Commission inquired of those respondents to its questionnaire who indicated possible interest in utilizing the Laboratories on a contractual basis whether they would have difficulty getting the work done elsewhere were the Laboratories not available. Fourteen firms stated that they would not encounter such difficulty; 11 anticipated difficulty; of these, 6 were contemplating pilot plant polymerization work, while the remaining 5 were considering evaluation and testing work.

While the Commission had neither the time nor the facilities to survey exhaustively the defense contracting chain through prime and subcontractors, the companies addressed in the survey described above were asked to indicate, in the case of contemplated contractual work at the Laboratories, whether such work was related to contracts with the Department of Defense. Six respondents reported that contemplated contractual work was so related, but in only 3 of these cases was difficulty anticipated in getting the work done elsewhere. Representatives of the Department of Defense informally expressed the opinion that defense contracts would not be seriously hindered in their execution were the Laboratories not available.

It is the opinion of the Commission that any companies having a continuing interest in the type of work now performed by the Government Laboratories would have only temporary difficulty in arranging for such work elsewhere, were the Laboratories to become unavailable.

4. The Commission has not found that transfer of the Government Laboratories to non-Government ownership would handicap the activities and programs of Federal agencies. On the other hand, the National Bureau of Standards might be able to utilize some part of the facilities in its general program of testing and standardization of materials.

The Department of Defense submitted the following statement to the Commission:

> "With respect to the Akron Laboratory, the Department of Defense is not prepared to underwrite the continuation of the facility. The military services will give consideration to its use on an individual project basis as appropriate."

In further conversations with the Department, it was confirmed that the Department would not consider the transfer of the facility to non-Government ownership as being in any way prejudicial to the interests of national defense.

The Department of Agriculture submitted the following statement to the Commission:

> "... We believe, further, that this Department's interests would not be adversely affected were the facility at Akron to be disposed of and thus no longer available for occasional use by the Department. Scientists of the Agricultural Research Service have taken advantage of opportunities in the past to pursue research projects in cooperation with the Akron Laboratories and have appreciated and profited by this relationship but we feel that our future contemplated programs related to this field of research would not be jeopardized if the Akron Laboratory should no longer be available as a Government facility."

The National Bureau of Standards submitted a more lengthy statement to the Commission, including the following comments:

> "If the Laboratory were transferred to the Department of Commerce and the National Bureau of Standards were assigned the responsibility for its administration, it appears at present that the most effective utilization of this facility would be achieved by integrating it with our own activities. This procedure would have the following advantages:
> (1) The expense and inefficiency of dual administration would be avoided.
> (2) Some activities in Washington could be transferred to Akron, which would result in more efficient utilization of space and facilities.
> (3) The needs of other Government agencies would be served more efficiently.
> (4) Contractors participating in the Government rubber research program would deal with only one organization to obtain the services of the Laboratory.
> (5) It would permit undertaking additional standardization activities in the rubber and polymer fields.
> (6) It would avoid duplication of some equipment, such as rubber mills, laboratory Banbury, vulcanization presses and testing equipment."

5. University scientists conducting fundamental research in rubber and elastomers would be inconvenienced but not seriously handicapped were services of the Government Laboratories no longer available to them.

Most of the scientists presently engaged in the Government's rubber research program avail themselves to varying degrees of testing, evaluation and other services of the Laboratories. It is estimated that of the annual operating cost of the Laboratories, about five per cent is attributable to the servicing of these basic research contractors.

The principal difficulties foreseen by the university scientists in case the Laboratories became privately owned are: (a) inconvenience of arranging for these services at their own expense; (b) uncertainty as to whether funds would be provided in their research budgets sufficient to cover the cost of paying for testing and evaluation services; and (c) difficulty of obtaining prompt pilot plant service and full disclosure of findings from private companies.

The difficulties envisioned are probably magnified somewhat by reluctance to contemplate modification of a very convenient and satisfactory pattern of relationships between the scientists and the Laboratories.[16] In any event, the Commission is convinced that the difficulties foreseen would not be insuperable and that continued Government ownership of the Laboratories is not essential to the success of the basic research program recommended in Chapter III of this Report.

6. The University of Akron has rendered a public service in managing and operating the Laboratories for the Government. It is possible that if the University became a purchaser of the facility, it might be able to obtain sufficient contracts on a continuing basis to meet operating costs.

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[16] Dr. Henry states: "I believe this negative comment about university investigators is unwarranted."

It appeared reasonable to the Commission to afford the University of Akron some basis for making a proposal for acquiring the Laboratories, and to ascertain the extent to which the University might be able to obtain industrially sponsored contracts for work at the Laboratories. Consequently, the Commission, at its first meeting, requested the National Science Foundation to modify its previous limited authorization to the University for the undertaking of two "trial contracts" and to grant unlimited authorization to the University to proceed with the solicitation of contracts. The Foundation immediately authorized the University to proceed along the lines suggested by the Commission. The University, during the course of a very limited solicitation, has developed contractual interest with individual companies in the amount of about $250,000. Additionally, as mentioned previously, several industrial firms, in responding to the Commission's questionnaire, indicated possible interest in future contracts. The present annual operating budget of the Laboratories amounts to $950,000, of which $50,000 represents a management fee to the University. Although no firm basis exists for prediction, it is conceivable that with strict economy in operating costs, the entire operation might be made self-supporting.

C. CONCLUSIONS

With the above findings, the Commission was able to narrow its consideration to three possible recommendations for future disposition of the Laboratories. First, transfer to the National Bureau of Standards; second, disposal to the University of Akron; and third, sale under negotiated terms. (Several other courses which had been suggested were found not to require serious consideration: transformation to an industry-wide research institute--impracticable due to lack of any organization in the industry suitable for such a purpose; transfer to the Department of Defense--not warranted in view of small defense interest in the facility; continued operation by the National Science Foundation--inconsistent with the functions of that agency.)

Transfer of the Facility to the National Bureau of Standards

The Commission noted certain advantages which might accrue to industry, the Government, and the general public were the Laboratories to be placed permanently under the Bureau of Standards. Any occasional need of the facility by Government agencies could be met easily, work which was not in any way competitive with private laboratories could be performed for industrial concerns on a fee or contractual basis, and the facility could integrate partially into the regular activities of the Bureau. However, the Commission is not convinced that acquisition of the facility is essential to the program of the Bureau of Standards, although that part of the facility concerned with physical testing and evaluation might be used by the Bureau in its programs of materials testing and standardization.

Disposal of the Facility to the University of Akron

This alternative was considered by the Commission from several standpoints. First, the University is desirous of obtaining the facility and has had extended experience in its operation. Second, since the University undoubtedly would follow an aggressive policy of contract solicitation, the services of the facility would be available to every possible interested segment of the rubber and chemical industries, and to the Government on a contractual basis when needed.

Under proposals so far submitted, the University has not indicated willingness to make a normal purchase of the facility at this time, nor to lease the facility and assume full responsibility for operating it as a business venture. To date, the University's proposals would require the Government to assume the financial uncertainties involved in attempting to place the facility on a self-sustaining basis with the Government continuing to pay the difference between income received by the University from contracts and the cost of operation and maintenance.

The Commission recognizes that the University has had very limited time within which to develop any possible potentials of the Laboratories as a self-supporting facility, and would not object to a lease of the facility to the University for an additional year provided no Government subsidy were involved. The Commission is firmly of the opinion that no justification exists for continued expenditure of taxpayers' funds to maintain and operate the Laboratories.

Disposal of the Facility to Private Ownership Through Negotiated Sale

The Commission is fully convinced that sale of the facility to a rubber, chemical, or other industrial concern or to a commercial laboratory or to a profit or nonprofit research institute would in no way be adverse to the Government or to the public interest generally. On the contrary, the Commission is convinced that since the Government is no longer a producer of synthetic rubber, continued Governmental operation of the Laboratories, built to serve as a division of the production complex, is no longer appropriate.

D. RECOMMENDATION

The Commission recommends that the Government Laboratories be offered for sale after June 30, 1956 through appropriate Government disposal channels, unless in the meantime the University of Akron accepts a lease, at a nominal fee, of the facility for the twelve months ending June 30, 1957, with no Government subsidy during that period, under such lease the University being obligated to maintain the facility in good condition but without obligation to maintain any particular scale of operations. If the University of Akron accepts such a lease, the disposal would be deferred for one year.

APPENDIX A

NSF Form 915
Oct. 1955

Serial No. _____

Special Commission for Rubber Research
National Science Foundation
Washington 25, D. C.

Gentlemen:

Subject: Interest, if any, in the Government Laboratories, Akron, Ohio.

In response to your recent letter we are indicating our interest and opinion on this subject as follows, with the understanding that we are under no resulting obligation or commitment:

1. Utilization of the Laboratories on a contractual basis:

   We might wish to contract for services provided by the Laboratories on an annual basis to the extent of:

More than	$100,000	_____
More than $50,000, less than	$100,000	_____
More than $10,000, less than	$ 50,000	_____
More than $ 1,000, less than	$ 10,000	_____
Less than	$ 1,000	_____
Not at all		_____

   Most of the above work would be:

   _____ pilot plant polymerization work
   _____ evaluation and testing work

   We (would) (would not) have difficulty in getting this work done elsewhere if the Laboratories were not available for these services.

   Is the above work related to contracts with the Department of Defense?
   Yes_____ No _____

2. Acquisition through purchase or lease:

   We might be interested _____
   We would not be interested _____

3. Remarks: (If any interest in acquisition, could you include an indication of whether the facility, if acquired, might be available for contractual work for the Government or other segments of the public interest)

_____
_____
_____
_____
_____
_____

Very truly yours,

Form Approved
Budget Bureau No. 99-5514

GPO 901983